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away in a seed catalogue, a weekly agricultural paper, or even a college monthly. Fortunately there is a growing tendency to have articles reprinted and distributed more or less freely among contemporaries. In addition to these various channels of publication, we have the thousands of books, pamphlets, and sheets devoted more or less to botanical subjects.

It is obviously impossible for a station botanist to have ready access to even a tenth-part of the accumulated literature. It is only at the larger public institutions that an attempt toward completeness is made.

But in botany, as in other sciences, the period has long since been reached when classification of its literature was necessary. Thus with the proper aids it is possible for every botanist to become fairly familiar with the literature on any subject.

Probably there are as many opinions as there are station botanists as to the selection to be made of these aids, and it is the object of this paper to give one opinion out of the many.

First, as to the periodicals; assuming, as is generally the case, that the funds for library purposes are quite limited. Most of us take from our own country at least the *Botanical Gazette* and the *Bulletin of the Torrey Botanical Club*. The latter is especially useful for its "Index to Recent Literature Relating to American Botany."

Of foreign periodicals I would mention the *Botanisches Centralblatt*, for its "Referate," under which heading are given classified reviews of important articles, and for its "Neue Literatur," which is an index, and a very complete one, to the current literature in all languages; the *Revue Générale de Botanique*, for its excellent reviews of the work done in various departments of botany during a given period; and the *Societatum Litterae*, giving monthly a classified list of articles published in the proceedings of scientific societies.

All will agree that by far the most important work is *Just's Botanischer Jahresbericht*. This gives an abstract, long or short, according to importance, of all the botanical articles published during the year. It is well indexed and classified.

Most of the station botanists are working more or less in special lines. The above-mentioned works will enable him to get at least the titles, and often an abstract of the contents, of nearly all the articles that have been published on his special subject. The most difficult period to cover is the last few months. *Just's Jahresbericht* is about two years behind, and the *Centralblatt* usually at least a few months.

Having at hand the titles and authors on a given subject, it is often desirable, or even necessary, to obtain the articles. Books, pamphlets, and reprints can usually be picked up through dealers in second-hand books. Separate numbers of the current periodicals and proceedings can usually be obtained. There remain such articles as are to be found only in the back numbers of serials. These are often very important and difficult to obtain. It is out of the question to think of purchasing these expensive works, for station libraries have too limited an income for this purpose. A good way is to be on the lookout for separate volumes containing the articles desired. But this requires some knowledge of the serials.

Three important works for this purpose and for botanical bibliography in general are Pritzel's "Thesaurus Literaturae Botanicae," Bolton's "Catalogue of Scientific Periodicals," and Scudder's "Catalogue of Scientific Serials."

After one obtains all the articles possible in this way, there will still be many that are unattainable. For these one must consult a large library. Short articles can then be copied, and notes can be taken of long ones. Photography will doubtless, in the future, play an important part in copying rare articles and plates. This can be done at a comparatively small expenditure of time and money, and has the immense advantage of being certainly correct.

I have said nothing about the selection of general works of reference and other books, as this depends so much on individual opinion and the line of work followed; but the above-mentioned aids to the botanist seem to me to be a necessary part of the equipment of every experiment station.

Agricultural College Experiment Station, Manhattan, Kansas.

## FORENSIC MICROSCOPY.

BY L. A. HARDING, B.SC., PH.D.

FORENSIC Microscopy, like Forensic Medicine, has a close connection to law; it also deals with cases which are closely interwoven with the administration of justice, and with questions that involve the civil rights and social duties of individuals, the detection of poisons as well as the treatments of the recovery of poison from the poisoned. More and more in the history of the criminal courts is the demand occasioned for the application of the microscope, and microscopical toxicology. Although of late a certain line of medico-legal research has been obliged to combat with the works of the undertaker, who, when preserving the bodies of the dead, employs preservative compounds, largely composed of arsenical and mercurial compounds, while there is no question as to their preservative properties, yet the question arises, Is it good policy, is it for the good of the community at large, to employ embalming fluids composed of such poisonous substances? Criminals may easily hide their heinous crimes by having their victims embalmed, and who is there to tell which of the poisons was administered by the hand of the coward who did not dare to do his work before the world and openly, who for pecuniary or other reasons sought this road to remove a good man, nay, perhaps the man least to be spared, and who is there to identify the poison introduced by legitimate (?) means from that introduced with murderous designs? Yet, despite this opposing energy, despite the seemingly unsurmountable difficulties which surround forensic microscopy and toxicology on every side, we are still making progress and demonstrate that "forensic microscopy" is destined to be a branch of science which cannot be ignored, try as the opposers may.

If we measure the future by the work and benefits the microscope has done in the past, it will be seen that a very bright prospect is awaiting us indeed. No instrument yet devised by the ingenuity of man can compare with the microscope in its universal application to research in the broad domain of science, and I will endeavor in a brief way to call attention to a few of its special relations to law.

The direct application of the microscope to law dates back to about 1835, and ever since that time it has made a record for itself in convicting the guilty and protecting the innocent. The expedient taught to us by Albertus in 1236, that the victim's wounds would open afresh in the presence of the slayer, or the custom honored from time immemorial of watching the effect upon the suspected criminal as he touched the dead body of his supposed victim, we no longer are obliged to resort to. In the early age of forensic microscopy, its application was simply confined to a few questions of criminal law; but the more it attained perfectness in lenses, the excellent means of determining minute measurements, the adaptation of the spectroscope, and numerous valuable mechanical appliances, it has claimed so much attention in civil and criminal law that its usefulness cannot be denied. Although the microscope has played a very important part for a number of years in noted criminal and civil cases, its proper relation to law seems to be little understood. It is true that many underrate its value, and throw aside all testimony attained through its use as worthless, while others again largely overrate its powers. It is a well-known fact, though an unfortunate existing condition of affairs, that persons are permitted to give expert testimony in branches where they have but little more knowledge than the court before whom they testify. It is largely from this cause that so much discredit has been thrown upon the whole field of expert testimony, especially in this country. This condition of fact does not alone relate to forensic microscopy, but it has invaded all branches of expert testimony.

When, however, persons expert in the use of the microscope are called upon to give testimony, there ought not to be any disagreement as to the result of the examination they may make; as, for instance, if they examine a stain, and blood corpuscles are found by one, it should be verified by the other; and, if measurements of these corpuscles are made, their measures should correspond without a doubt. There should be no difference on such matters of fact, though this is not meant to imply that they should

not honestly differ as to how the blood came there. The microscope will tell with true and unerring certainty whether the adhering substance on a weapon is human or animal hair, or whether what is thought to be hair is not cotton, silk, or wool fibre. It is a well-known fact that portions of brain-substance adhering to weapons which have caused the fracture of the skull and laceration of the brain can only be recognized by the microscope. While, when the substance is fresh it cannot easily be mistaken, it is quite different when it becomes dry; it will then assume a gray or brown color, and become quite horny. In this state no physical appearance can tell what it is, the naked eye is at a loss to recognize its source. Quite different with the microscope; it will tell you. Moisten the substance, and you will see its color become whiter and its consistence quite soapy. Now if you soften the mass in a solution of common salt, I will show you nerve-cells or nerve-fibres; though so small, being only  $\frac{1}{1000}$  of an inch or less in diameter, you shall see them plain and distinct. Likewise, hair adhering to clubs or weapons of any kind can be recognized as to its source, whether it has been torn out by force or not. If by force, we plainly see the tubular sheath of the hair, with the hair issuing from it; the color is distinguishable, the size, and whether they are cut at both ends or pointed at one, whether the bulb or sheath in which it grows is still attached to them, etc. It may not be amiss to state that hair from lower animals differs in a great many particulars from that of man; the hairs of animals, generally speaking, are coarser, thicker, shorter, and less transparent. The ones which bear a close resemblance to that of man are the spaniels and sky terriers whose hair is long and silky, though the linear markings on the cortical portions are not so numerous and fine. It is a deplorable fact that very little of value has been written upon the subject of hair in its medico-legal relation. While it cannot be denied that all the works on forensic medicine mention this subject, yet they are based upon very little original research; they are mainly copied one from another. We shall say more on this subject at a later date; we are willing to admit that it may not at all times be perfectly discernible as to the source of the hair, yet, when taken in conjunction with other evidence, doubt may be removed and positive evidence established.

It is understood, of course, that the examination of supposed weapons should be conducted with the greatest care, and notes taken, full notes in fact of all the detail and every process in the operation; especially spots and marks which can have any possible bearing upon the case under question should be carefully noted.

In the broad domain of chemistry and toxicology the microscope is a very important factor for the identification and verification of many ordinary tests, which are made to determine the composition of solids and liquids. Not many years ago, death from poison was surrounded by dread and fear scarcely comprehensible at the present day. Tradition informs us that persons suspected of having committed murder by poisoning were broiled alive in England, and in France burned at the stake, and in the various other countries tortured in the most inhuman manner. It is now, however, generally conceded that, with modern methods introduced for the detection of poison, the fear of discovery has been rendered greater than the dread of punishment. The greatest advance in legal chemistry was through the achievements of Bunsen and others; quantities so minute as to be out of reach of all other known methods of analysis, we are enabled to identify with unerring certainty. Many poisons, such as strychnine, arsenic, morphine, etc., will crystallize with certain reagents into characteristic forms, which are peculiar to themselves.

Of late considerable attention has been paid to the microscopical examination of hand-writings. While perhaps the microscope cannot be considered an aid in forming an opinion as to the real author of a given specimen, yet its value for the detection of alteration and changes made in the original cannot be underrated. It is impossible to make an erasure of any written or printed lines and hide them from detection by the microscope; the most skillful forger cannot restore the slightest derangement of the fibres on the finished surface of the paper.

Equipped with the modern improvements and possessing the requisite skill, the progressive microscopist may be said to be a true friend of the curious, in the full meaning of this expression. It is true that sometimes our most exhaustive means of industry and research are only rewarded by negative results; yet it cannot be denied that in the majority of cases we reap the reward of diligence and industry by seeing our work change the whole theory of a plea in civil and criminal action, becoming a terror to the guilty and joy to the innocent.

THE tenth congress of the American Ornithologists' Union will convene in Washington, D. C., on Tuesday, November 15, 1892, at eleven o'clock, A. M. The meetings will be held at the U. S. National Museum. The reading of papers will form a prominent feature of the meetings. Associate as well as active members are earnestly requested to contribute, and to notify the secretary before November 12 as to the titles of their communications and the length of time required for their presentation, so that a programme for each day may be prepared.

— Among the articles of the November number of *The Forum* is one on "The Library of the United States" by Mr. Ainsworth R. Spofford, Librarian of Congress, who explains the rank that this great library will take among the great libraries of the world. In the series of articles on Municipal Government there appear two contributions in the November number: 1, by the Rt. Hon. Joseph Chamberlain, who compares the Government of Birmingham, England, with the Government of Boston, and tries to ascertain why Boston's government costs five times as much as Birmingham's, they being cities of about the same size; and 2, by Mr. Charles Francis Adams, who points out lessons from the municipal experience of Quincy, Massachusetts. Professor Edward S. Holden, Director of Lick Observatory, tells what we really know about Mars. In the series of articles giving the results of his investigations into our public-school system, contributed by Dr. J. M. Rice, the November number contains his study of the schools in Buffalo and Cincinnati.

— Mr. O. P. Hay has furnished for recent "Proceedings of the National Museum" three interesting biological papers. The first is entitled "On the Ejection of Blood from the Eyes of Horned Toads," and establishes beyond question the fact that under certain conditions about the time of moulting *Phrynosoma coronatum* ejects from the eye a small quantity of blood. Mr. Hay records personal observations on the toads, and also quotes the experiences of others. Professor L. M. Underwood furnishes the following account: "In 1885 a student of mine received a specimen of horned toad from California. In examining the animal I took occasion to turn him on his back, using a lead pencil for the purpose. The animal resented this treatment, and showed considerable anger, opening his mouth and puffing up his body. On being irritated still more, he grew more and more enraged, until finally blood spurted from just above his eye to a distance at least a foot from the animal, as several spots struck my arm considerably above the wrist. After spurting the blood the animal became limp and collapsed, and remained in a stupor for some time; and when handled behaved as if dead. After a time, possibly not over five or six minutes, certainly not over ten, the animal revived and commenced to run about the table. Wishing to know if he would repeat the operation, I commenced to irritate him again in the same manner. After becoming enraged again, the animal soon went through the same process, ejecting blood from the same eye as before. He then fell into a similar stupor and remained about the same length of time, after which he revived. No amount of irritation could produce a third discharge, although the animal showed some anger." Mr. Hay also records "Some Observations on the Turtles of the Genus *Malaclemys*," and presents a number of interesting facts concerning "The Breeding Habits, Eggs, and Young of Certain Snakes." No. 905 of the Museum "Proceedings" consists of a valuable paper by Mr. L. O. Howard on "The Insects of the Sub-Family Encyrtinæ with Branched Antennæ." Three new genera (*Pentacnemus*, *Tetracladia*, *Calocerinus*) and species are described, five species being figured.